Reminders 02-18-10:

-4th POW due Today by 5PM

-Quiz 4 in lecture Today.

-Quiz 5 Thursday Ch.5 and 6 in Lecture.

-Homework 5 Due Tuesday the 23rd.

-Minor Changes made to Atwood's Lab.

-I Won't Be Here Much Tomorrow

Objectives:

-Newton's Laws Applied to Circular Motion

-Inertial Reference Frames

-Air Resistance

$$\sum \vec{F} = m\vec{a}$$

Causes ↑ Effect

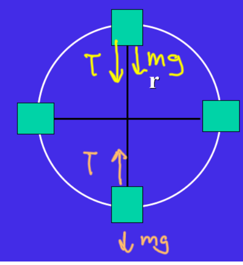
↑

free-body diagram

↓

$$\sum \vec{F} = \frac{mv^2}{r}$$

A 1 kg rock is tied to a 1 m string and whirled in a vertical circle. What is the tension in the string at the top if the speed is 5 m/s and at the bottom if the speed is 5.67 m/s.



$$-T - mg = -\frac{mv^2}{R} \qquad T = \frac{mv^2}{r} - mg$$

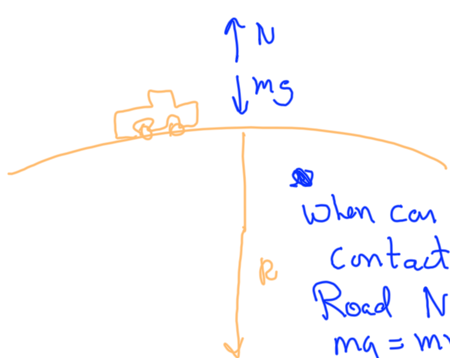
$$T = (1\,kg)\left(\frac{(5\,m/s)^2}{1\,m} - 9.80\,m/s^2\right)$$

$$= 15.2\,N$$

$$T - mg = +\frac{mv^2}{r} \qquad T = mg + \frac{mv^2}{r}$$

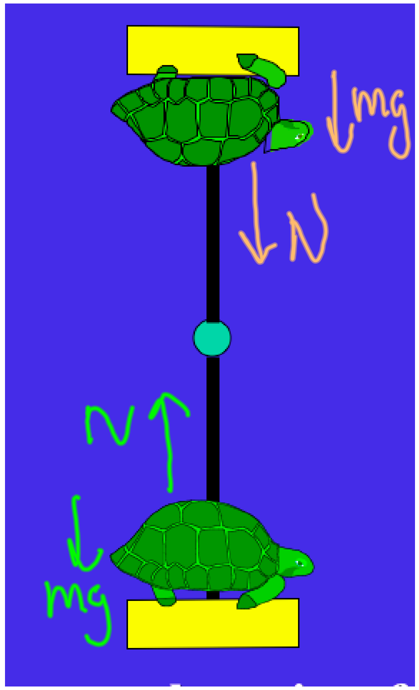
$$T = m\left(g + \frac{v^2}{r}\right)$$

$$= (1\,kg)\left(9.80\,\frac{m}{s^2} + \frac{(5.67\,\frac{m}{s})^2}{1\,m}\right) = 42\,N$$



When car loses contact with Road $N = 0$

$$mg = \frac{mv^2}{R}$$



$$-N - mg = -\frac{mv^2}{r}$$

$$N = \frac{mv^2}{r} - mg$$

$$= m\left(\frac{v^2}{r} - g\right)$$

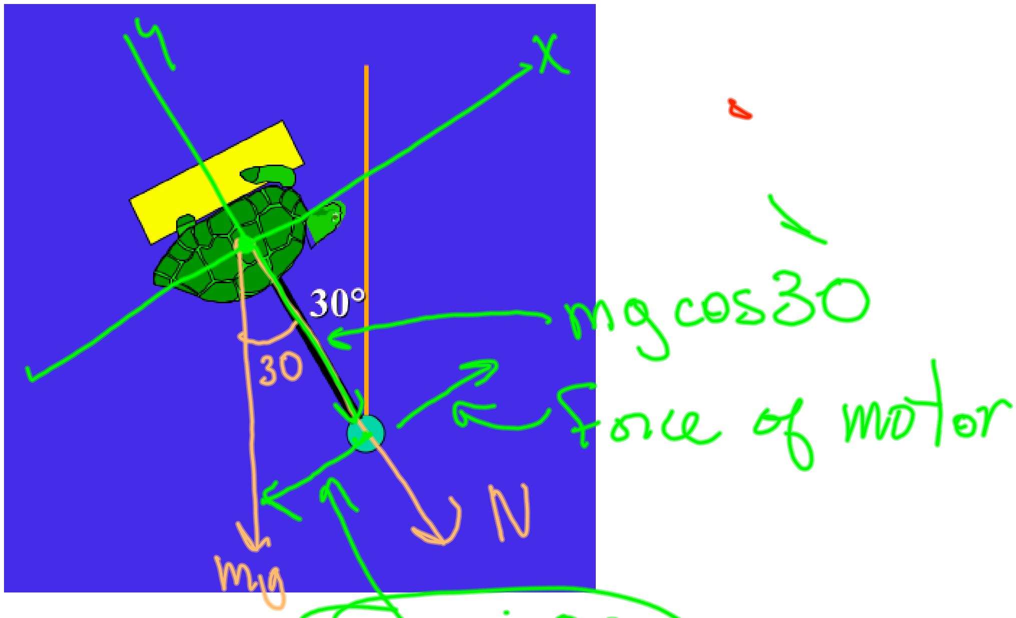
$$= 50\,kg\left(\frac{(5\,m/s)^2}{m} - 9.80\right)$$

$$= 760\,N$$

$$N - mg = \frac{mv^2}{r} \qquad N_{bottom} = m\left(\frac{v^2}{r} + g\right)$$

$$N_{bottom} = 50\,kg\left[\frac{(5\,m/s)^2}{1\,m} + 9.80\right]$$

$$= \underline{1740\,N}$$



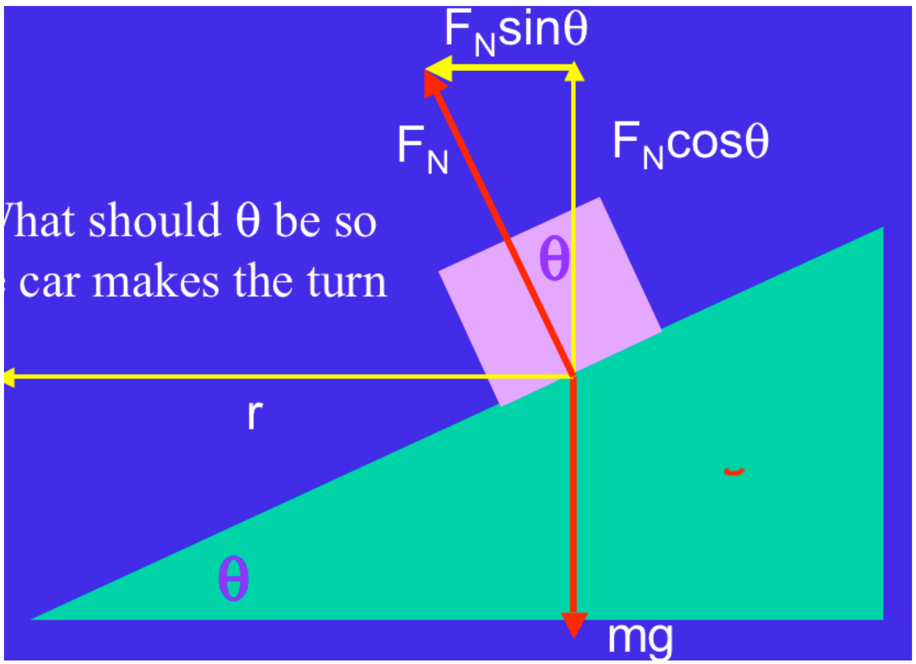
mgsin30

$$\Sigma F = -N - mg\cos 30 = -\frac{mv^2}{r}$$

$$N = \frac{mv^2}{r} - mg\cos 30$$

$$= 50\,kg\left[\frac{(5\,m/s)^2}{1\,m} - 9.8\cos 30\right]$$

$$= 830\,N$$

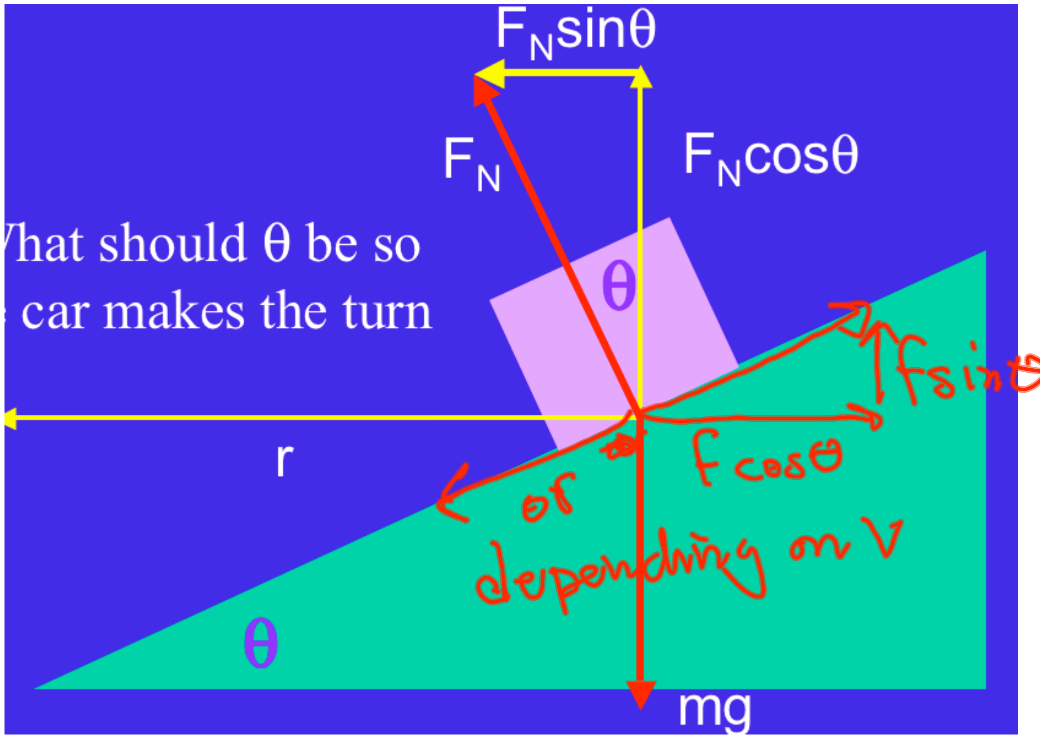


$$\Sigma F_x = +F_N\sin\theta = +\frac{mv^2}{r}$$

$$\Sigma F_y = F_N\cos\theta = mg$$

$$\frac{F_N\sin\theta}{F_N\cos\theta} = \frac{\frac{mv^2}{r}}{mg}$$

$$\tan\theta = \frac{v^2}{rg}$$



Let's Include friction

$$\Sigma F_x = -F_N\sin\theta \pm f\cos\theta = -\frac{mv^2}{r}$$

$$\Sigma F_y = F_N\cos\theta - mg \pm f\sin\theta = 0$$

At point where it starts to slide, $f = \mu_s F_N$